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(54) WIRELESS TERMINALS AND METHODS THAT CAN ACQUIRE A CDMA SYSTEM WHILE CONTINUING TO RECEIVE PAGING MESSAGES FROM AN AMPS SYSTEM

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(57) **ABSTRACT**

Multiple-mode AMPS system/CDMA system wireless terminals attempt to acquire the CDMA system independent of receiving a Global Action (GA) overhead message from the AMPS system, while continuing to receive paging messages from the AMPS system. In response to the attempt being successful, the multiple-mode AMPS/CDMA wireless terminals transition from the AMPS system to the CDMA system. The attempting may be performed by receiving paging messages from the AMPS systems during spaced apart time intervals and attempting to acquire the CDMA system between the spaced apart time intervals. Specifically, a paging message may be received from a first frame of an AMPS control channel of the AMPS system and an AMPS sleep mode is entered thereafter. CDMA pilot acquisition data may be accumulated during the AMPS sleep mode. These operations may be repeated for second and subsequent frames of the AMPS control channel, until sufficient CDMA pilot acquisition data is accumulated to acquire the CDMA pilot and/or the CDMA System ID (SID) field.

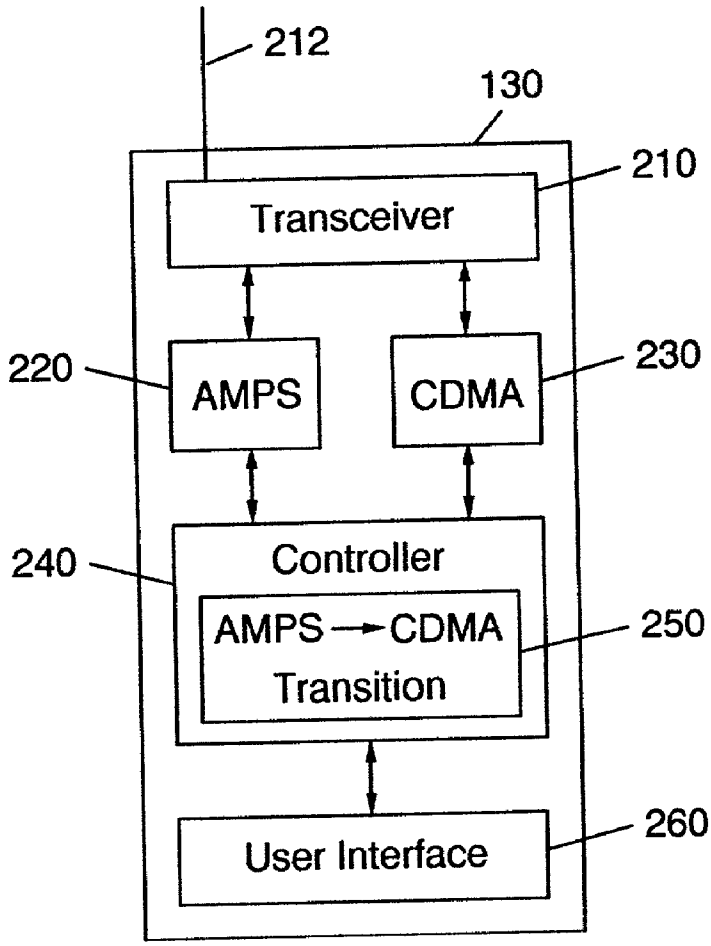


FIG. 1

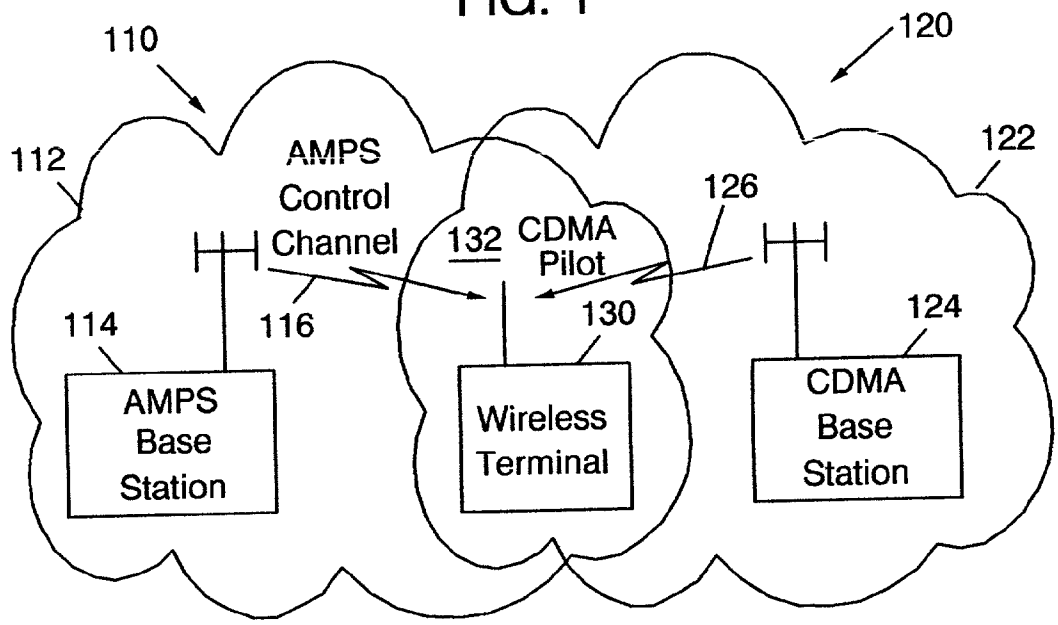

110
120
112
AMPS
Control
Channel
132
CDMA
Pilot
126
122
114
116
130
124
AMPS
Base
Station
Wireless
Terminal
CDMA
Base
Station

FIG. 2

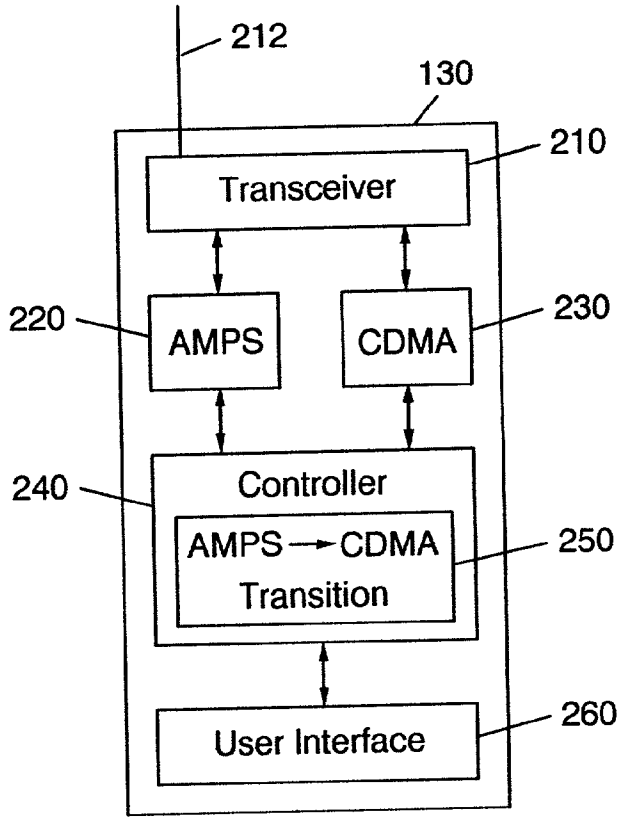

212
130
210
Transceiver
220
AMPS
CDMA
230
240
Controller
AMPS → CDMA
Transition
250
User Interface
260

FIG. 3

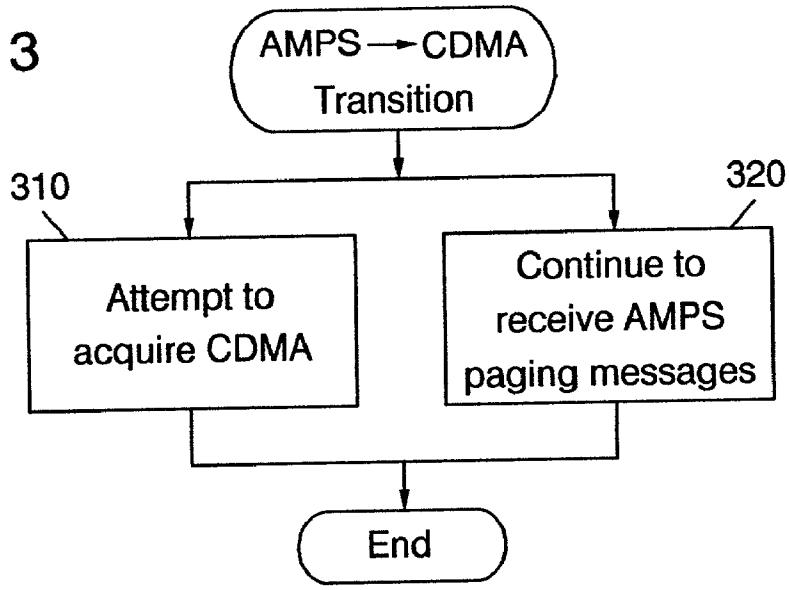

AMPS → CDMA Transition
310
320
Attempt to acquire CDMA
Continue to receive AMPS paging messages
End

FIG. 4

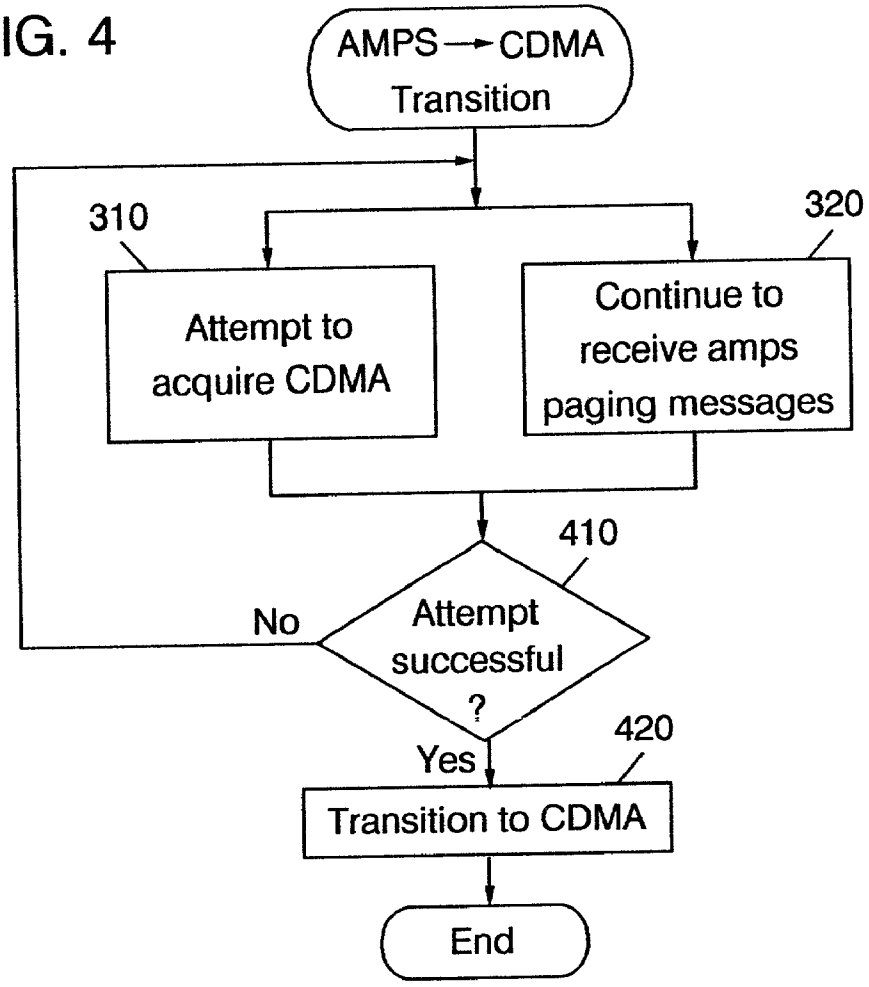

AMPS → CDMA Transition
310
320
Attempt to acquire CDMA
Continue to receive amps paging messages
410
Attempt successful ?
No
Yes
420
Transition to CDMA
End

FIG. 5

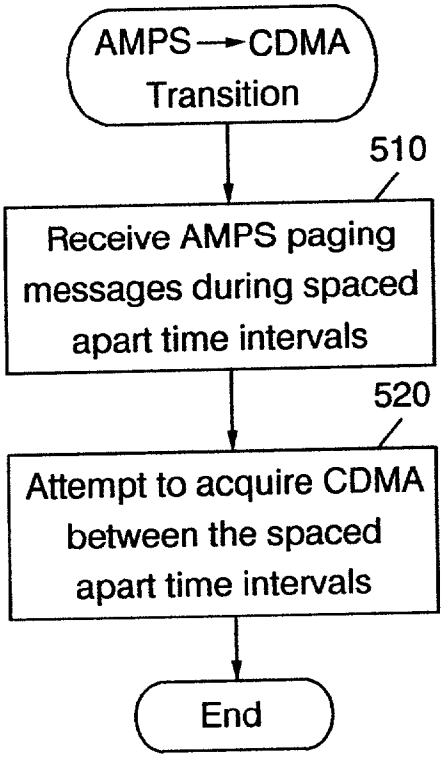

AMPS → CDMA Transition
510
Receive AMPS paging messages during spaced apart time intervals
520
Attempt to acquire CDMA between the spaced apart time intervals
End

FIG. 6

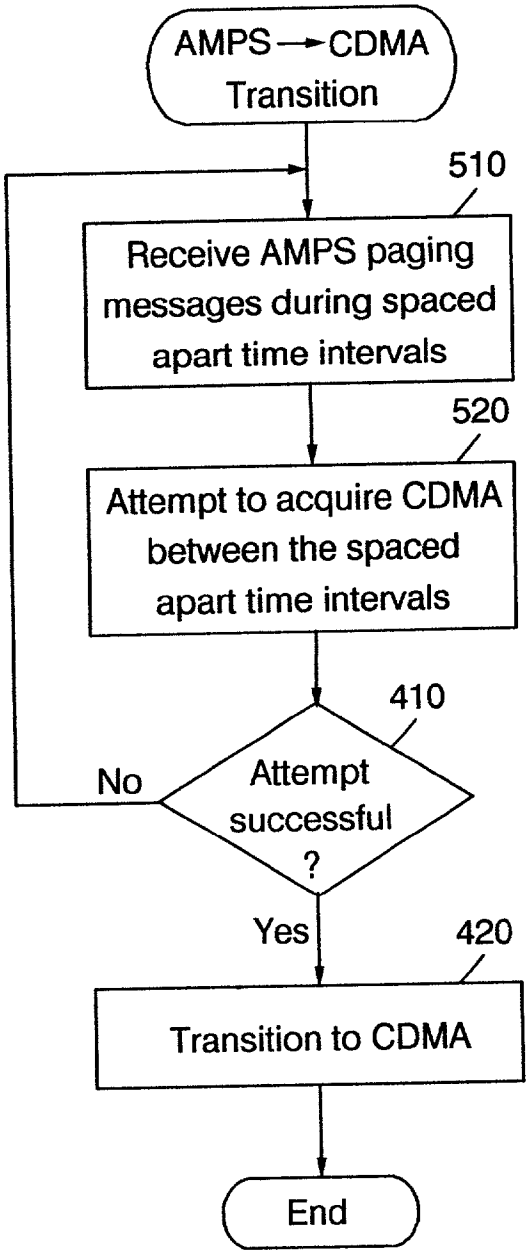

AMPS → CDMA Transition
510
Receive AMPS paging messages during spaced apart time intervals
520
Attempt to acquire CDMA between the spaced apart time intervals
410
Attempt successful ?
No
Yes
420
Transition to CDMA
End

FIG. 7

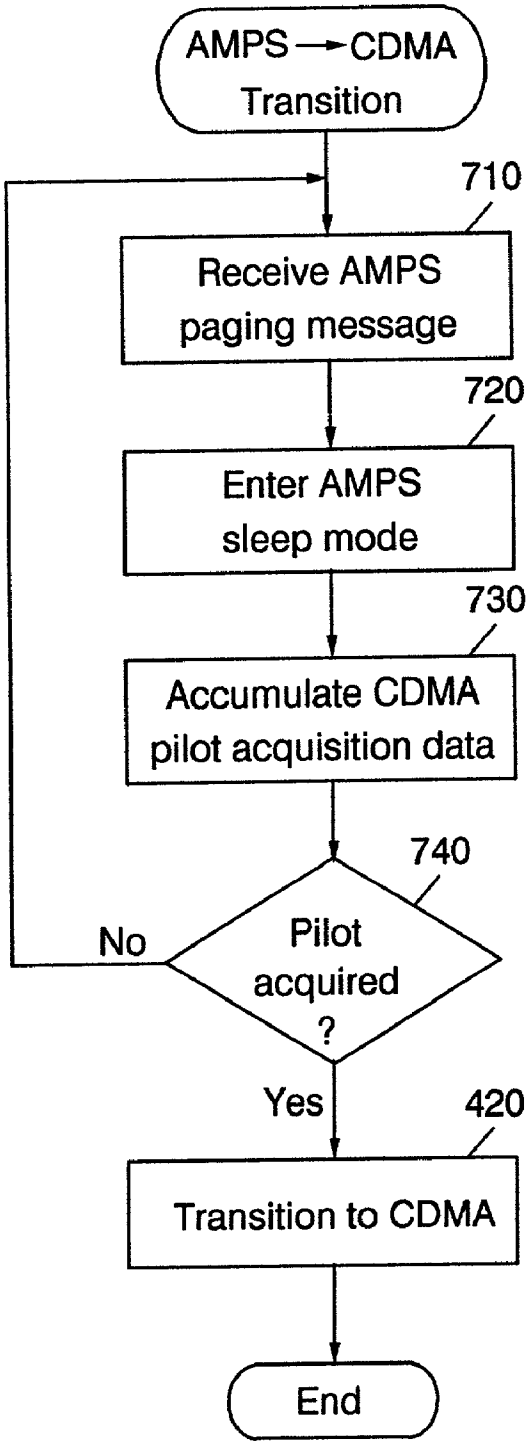

AMPS → CDMA Transition
710
Receive AMPS paging message
720
Enter AMPS sleep mode
730
Accumulate CDMA pilot acquisition data
740
Pilot acquired ?
No
Yes
420
Transition to CDMA
End

FIG. 9

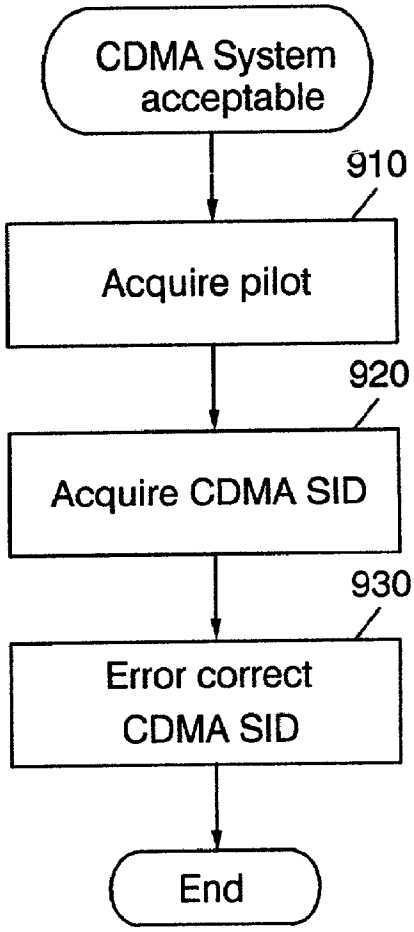
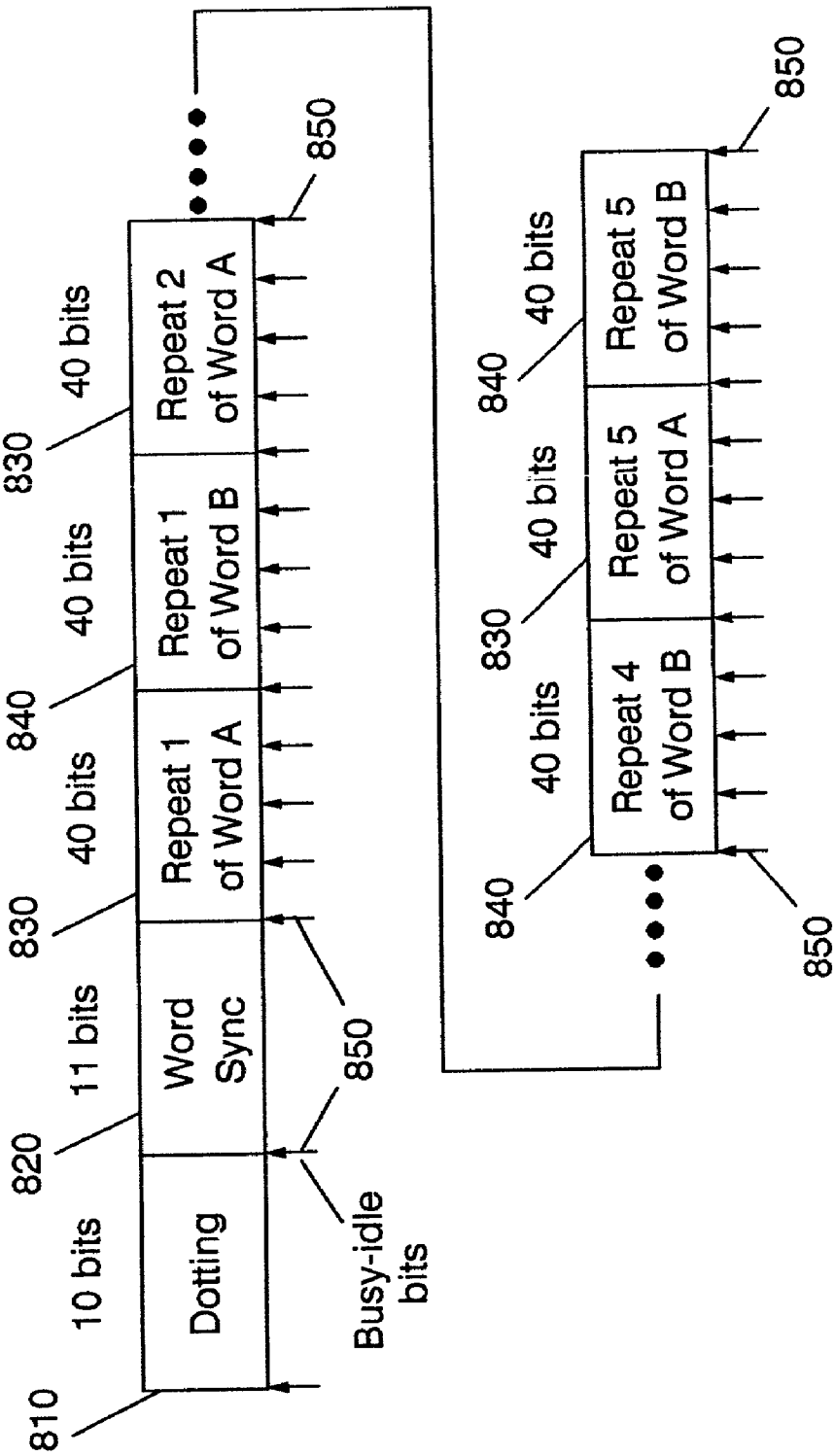

CDMA System acceptable
910
Acquire pilot
920
Acquire CDMA SID
930
Error correct CDMA SID
End

FIG. 8


Dotting
10 bits
810
Word Sync
11 bits
820
Repeat 1 of Word A
40 bits
830
Repeat 1 of Word B
40 bits
840
Repeat 2 of Word A
40 bits
830
850
Busy-idle bits
850
Repeat 4 of Word B
40 bits
840
Repeat 5 of Word A
40 bits
830
Repeat 5 of Word B
40 bits
840
850
850

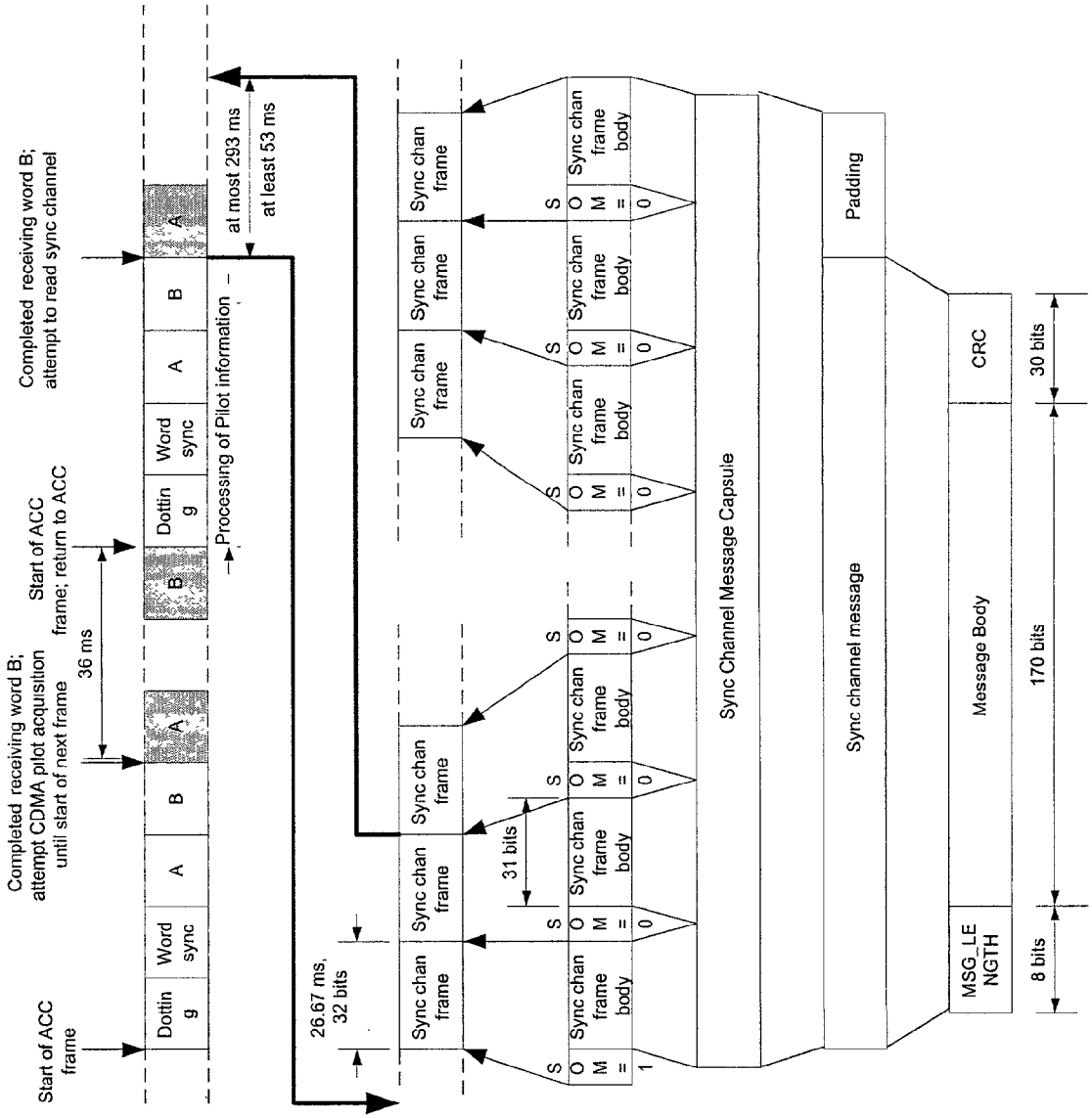
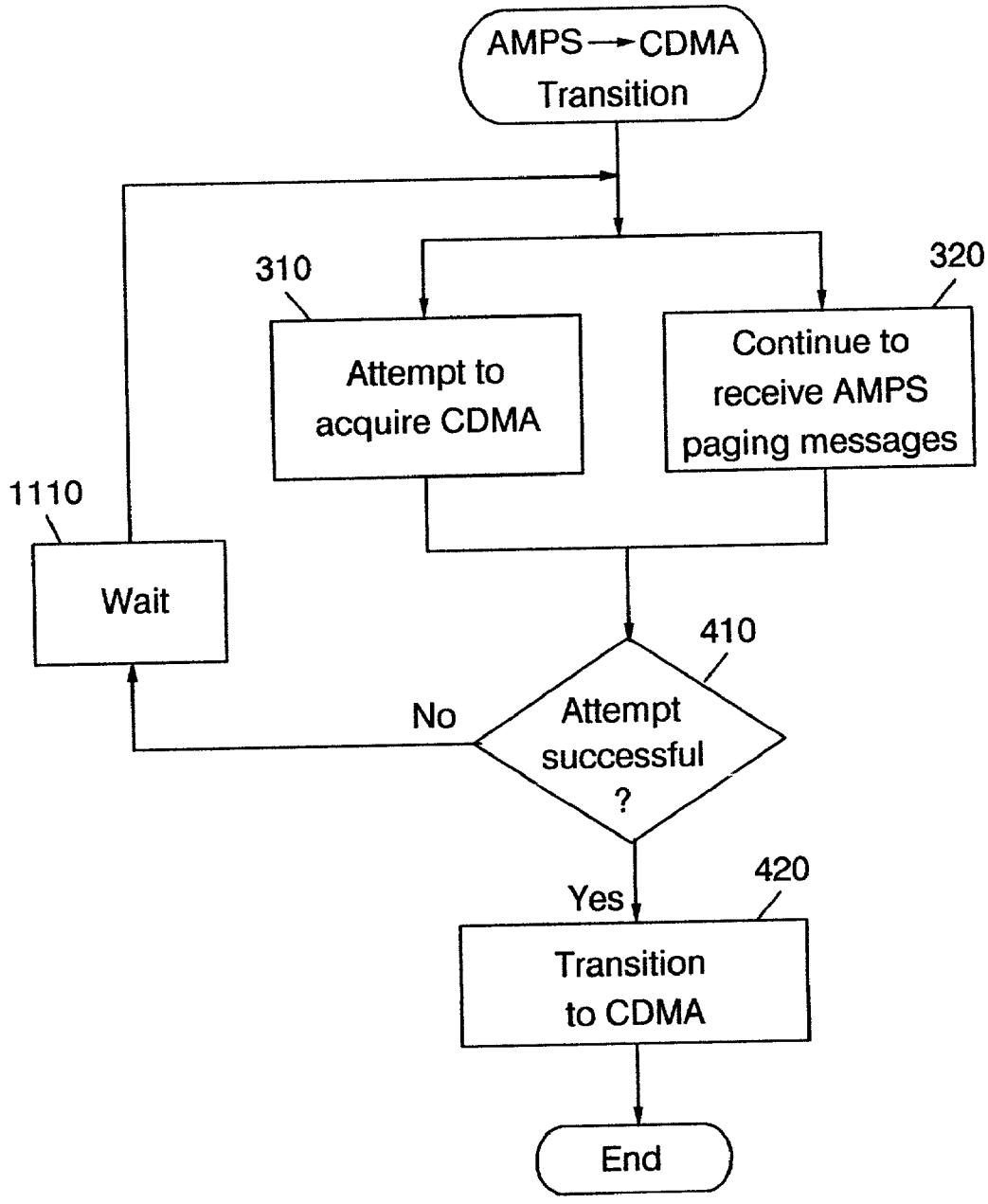

Start of ACC frame
Dottin g
Word sync
A
B
A
Completed receiving word B; attempt CDMA pilot acquisition until start of next frame
36 ms
Start of ACC frame; return to ACC
B
Dottin g
Word sync
A
B
A
Completed receiving word B; attempt to read sync channel
Processing of Pilot information
at most 293 ms
at least 53 ms
26.67 ms, 32 bits
Sync chan frame
S
O M = 0
Sync chan frame body
31 bits
Sync Channel Message Capsule
Sync channel message
Padding
MSG_LE NGTH
Message Body
CRC
8 bits
170 bits
30 bits

FIG. 10

FIG. 11


AMPS → CDMA Transition
310
Attempt to acquire CDMA
320
Continue to receive AMPS paging messages
1110
Wait
410
Attempt successful ?
No
Yes
420
Transition to CDMA
End

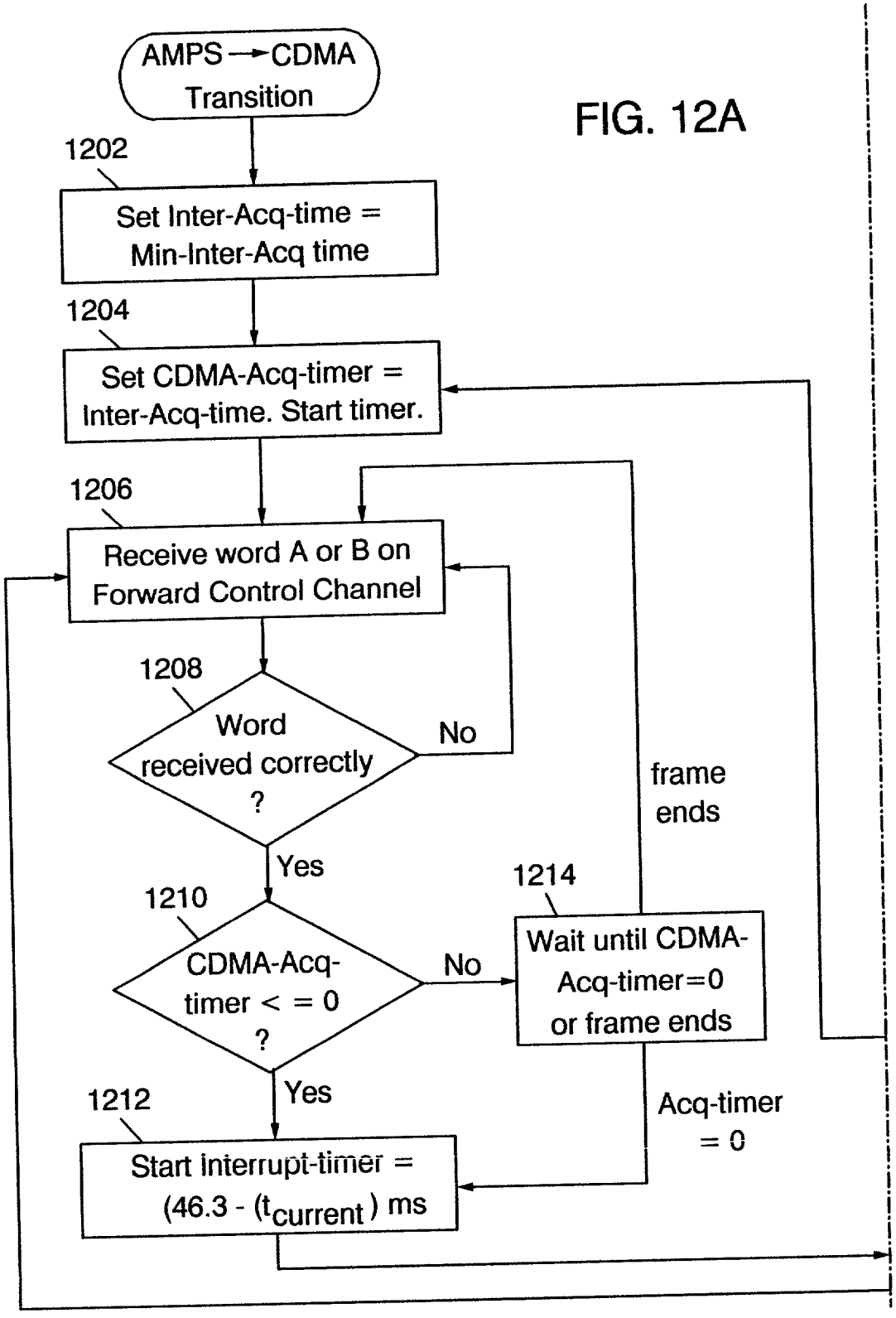
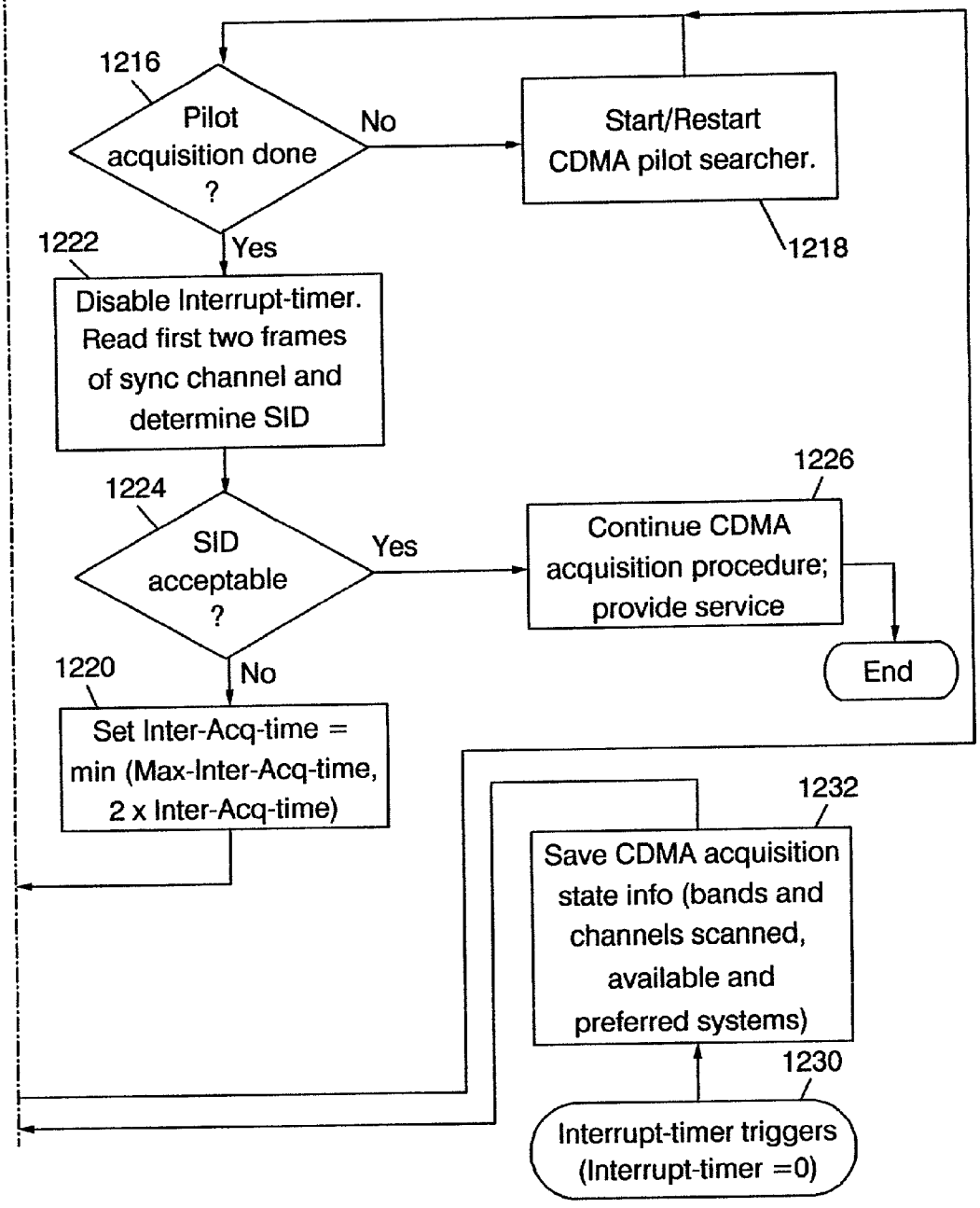

AMPS → CDMA Transition
1202
Set Inter-Acq-time = Min-Inter-Acq time
1204
Set CDMA-Acq-timer = Inter-Acq-time. Start timer.
1206
Receive word A or B on Forward Control Channel
1208
Word received correctly ?
No
Yes
1210
CDMA-Acq-timer < = 0 ?
No
Yes
1212
Start interrupt-timer = (46.3 - ($t_{current}$) ms
1214
Wait until CDMA-Acq-timer=0 or frame ends
frame ends
Acq-timer = 0

FIG. 12A

FIG. 12B

FIG. 12

FIG. 12A	FIG. 12B



WIRELESS TERMINALS AND METHODS THAT CAN ACQUIRE A CDMA SYSTEM WHILE CONTINUING TO RECEIVE PAGING MESSAGES FROM AN AMPS SYSTEM

BACKGROUND OF THE INVENTION

[0001] This invention relates to wireless communications terminals and operation methods, and more particularly to multiple-mode wireless terminals that can operate under both an Advanced Mobile Phone Service (AMPS) and a Code Division Multiple Access (CDMA) system.

[0002] Wireless communications systems and methods are widely used for voice and/or data communications. Wireless communications systems and methods include CDMA systems that operate, for example, under standards TIA/EIA-95 and IS-2000 and non-CDMA systems, referred to herein as AMPS systems, that operate, for example, under standards EIA/TIA/IS-3, TIA/EIA/IS-91 and TIA/EIA/IS-136. In CDMA systems, each user is assigned a unique code, and transmissions to and from wireless terminals are spread in parallel over a common band of frequencies. CDMA systems also have a dedicated pilot signal that is code spread over the channel bandwidth. AMPS systems can include one or more analog or digital control channels, and at least one traffic channel.

[0003] Multiple-mode AMPS/CDMA wireless terminals, i.e. wireless terminals that can operate with both AMPS (i.e. non-CDMA) and CDMA systems, are known. For example, wireless terminals operating according to standards IS-95 and IS-2000 may operate on both CDMA systems, as well as AMPS systems. As used herein, the term "wireless terminal" includes cellular radiotelephones with or without a multi-line display; Personal Communications System (PCS) terminals that may combine a cellular radiotelephone with data processing, facsimile and/or data communications capabilities; Personal Data Assistants (PDA) that can include a radiotelephone, pager, Internet/intranet access, Web browser, organizer, calendar and/or a global positioning system (GPS) receiver; and/or conventional laptop and/or palmtop receivers or other appliances, which include a radio frequency transceiver.

SUMMARY OF THE INVENTION

[0004] According to embodiments of the present invention, multiple-mode AMPS system/CDMA system wireless terminals and operating methods attempt to acquire the CDMA system independent of receiving a Global Action (GA) overhead message from the AMPS system, while continuing to receive paging messages from the AMPS system. In response to the attempting being successful, embodiments of multiple-mode AMPS/CDMA wireless terminals and operating methods transition from the AMPS system to the CDMA system. In yet other embodiments, attempting to acquire the CDMA system independent of receiving the GA overhead message while continuing to receive paging messages is performed by receiving paging messages from the AMPS systems during spaced apart time intervals and attempting to acquire the CDMA system between the spaced apart time intervals. In still other embodiments, a word on the control channel is received from a first frame of an AMPS control channel of the AMPS system and an AMPS sleep mode is entered thereafter. CDMA pilot data is accumulated during the AMPS sleep mode. These operations of receiving a paging message, entering an AMPS sleep mode and accumulating CDMA pilot data may be repeated for second and subsequent frames of the AMPS control channel, until sufficient CDMA pilot acquisition data is accumulated to acquire the CDMA pilot and/or the CDMA System ID (SID) field.

BRIEF DESCRIPTION OF THE DRAWINGS

[0005] **FIG. 1** is a schematic diagram illustrating multiple-mode AMPS/CDMA wireless terminals and operating methods according to embodiments of the present invention.

[0006] **FIG. 2** is a block diagram of multiple-mode AMPS/CDMA wireless terminals according to embodiments of the present invention.

[0007] FIGS. **3-7** are flowcharts of AMPS-to-CDMA transitions according to embodiments of the present invention.

[0008] **FIG. 8** illustrates an example of a forward control channel datastream for an AMPS system.

[0009] **FIG. 9** is a flowchart of determining whether a CDMA acquisition attempt is successful according to embodiments of the invention.

[0010] **FIG. 10** illustrates a detailed timing diagram of a synchronization channel message for a CDMA system.

[0011] **FIGS. 11 and 12**A-12B are flowcharts of other AMPS-to-CDMA transitions according to embodiments of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[0012] The present invention now will be described more fully hereinafter with reference to the accompanying drawings, in which embodiments of the invention are shown. This invention may, however, be embodied in many different forms and should not be construed as limited to the embodiments set forth herein. Rather, these embodiments are provided so that this disclosure will be thorough and complete, and will fully convey the scope of the invention to those skilled in the art. Like numbers refer to like elements throughout.

[0013] **FIG. 1** is a schematic diagram illustrating multiple-mode AMPS/CDMA wireless terminals and methods according to embodiments of the present invention that operate under an AMPS system and a CDMA system, also referred to herein as an AMPS wireless communications system and a CDMA wireless communications system, respectively. More specifically, referring to **FIG. 1**, an AMPS system **110** that can operate under one or more of the above cited or other standards employs one or more cells to cover an AMPS system geographic area **112** using one or more AMPS base stations **114**. One or more wireless terminals **130** acquire the AMPS system **110** using one or more AMPS control channels **116** that are broadcast from the AMPS base stations **114**, as will be described in detail below.

[0014] Still referring to **FIG. 1, a** CDMA system **120** includes one or more CDMA cells that operate over a CDMA geographic area **122** using one or more CDMA base stations **124**. The CDMA system is acquired by one or more

wireless terminals **130** by receiving a CDMA pilot **126** that is broadcast from the CDMA base stations **124** to the wireless terminals **130**. The design and operation of AMPS systems **110** and CDMA systems **120** are well known to those having skill in the art and need not be described further herein.

[**0015**] As shown in **FIG. 1**, the geographical area **112** of the AMPS system **110** and the geographical area **122** of the CDMA system **120** may overlap, as indicated at an overlap area **132**. When a wireless terminal **130** is located in the overlap are **132**, as shown in **FIG. 1**, it may be desirable for the wireless terminal **130** to transition from operating under the AMPS system **110** to operating under the CDMA system **120**, because the CDMA system **120** can offer longer battery life, higher capacity and/or better voice quality.

[**0016**] When the CDMA and AMPS systems **120** and **110**, respectively, in a particular region are owned and operated by the same carrier, it is known that the carrier can benefit by informing the wireless terminals **130** that are using the AMPS system **110** that the CDMA system **120** is potentially available. Pursuant to standard TIA/EIA/IS-95-B, entitled *Mobile Station-Base Station Compatibility Standard for Dual-Mode Spread Spectrum Systems,* Section 3.1, Oct. 31, 1998, a Global Action (GA) overhead message, with the CDMA_AVAIL bit set to 1, is used in the AMPS control channel **110** to indicate to a wireless terminal **130** that CDMA service is available. If this message is received on the AMPS control channel **116**, the wireless terminal **130** can begin a search for a CDMA pilot **126** and try to acquire CDMA service.

[**0017**] However, it is not mandatory for the AMPS carrier to inform the wireless terminal **130** of the availability of CDMA service. For example, if the AMPS and CDMA systems **110** and **120**, respectively, belong to different carriers, it is known that the GA overhead message that was described above may not be used. Moreover, it is also known that carriers may not use the GA overhead message as described above, even if they have control of both the AMPS systems and the CDMA systems in a given geographical region. Embodiments of the present invention can provide wireless terminals and operating methods that can attempt to acquire a CDMA system independent of receiving a GA overhead message from the AMPS system **110**.

[**0018**] Prior to describing additional details of wireless terminals and operating methods according to embodiments of the present invention, a general discussion of system acquisition will be provided. System acquisition refers to obtaining and demodulating signals from a base station on a specific channel, so as to obtain system information that is used for synchronization. System acquisition brings the wireless terminal **130** to a state in which it can originate and receive wireless communications. The channel which is to be demodulated generally depends on whether acquisition is being made for the AMPS system **110** or the CDMA system **120**. Furthermore, the manner in which synchronization is achieved, and the system information that is transmitted generally is dependent on whether an AMPS system **110** or CDMA system **120** is being acquired.

[**0019**] System acquisition of the AMPS system **110** can be based directly on FM radio principles. For example, 21 AMPS control channels **116** may be available for each of System A and System B. A wireless terminal **130** measures a Received Signal Strength Indication (RSSI) for all of the AMPS control channels and can pick the two signals with the highest RSSI. It then attempts to synchronize with the channel with the highest RSSI. If this attempt fails, then the wireless terminal **130** tries to synchronize with the second AMPS control channel. If synchronization fails, the wireless terminal **130** proceeds to scan the other sub-band. Channel validation then is performed to determine if the signals are control channels or voice channels. If both are voice channels, the wireless terminal **130** scans the other band. Otherwise, system parameter information is obtained from the AMPS control channel **116**. The wireless terminal **130** continues to listen to the AMPS control channel **116** as long as the AMPS system **110** is being used for service. Messages to the wireless terminal **130**, such as paging, alert and overhead messages, are received at the wireless terminal **130** from the AMPS base stations **114** via the AMPS control channel **116**. Acquisition is described in more detail in the AMPS standards that were cited above, and need not be described in further detail herein.

[**0020**] In contrast, CDMA systems **120** include a pilot signal **126** that is code spread over a channel bandwidth, for example of 1.25 MHz. The pilot signal may be a 2^{15} bit long pseudo-noise code that is transmitted continuously. All CDMA base stations **124** may transmit the same code. However, in order to allow the base stations **124** to be distinguished, base stations which can potentially interfere with each other can transmit the code with an offset of 64×n bits, where n is greater than or equal to 2.

[**0021**] CDMA terminals may use an array of three or more receivers known as RAKE receivers, including fingers which demodulate or despread respective signals corresponding to respective multipaths. CDMA terminals can combine the demodulated multipaths after matching the delays to obtain a stronger signal that can be more resistant to fast fading. One or more of the fingers may be used as a pilot searcher. It can constantly search for different pilots **126** and their multipaths. The pilot searcher can direct the other fingers to various pilots and their multipaths, as desired. The rake fingers then can be programmed to demodulate the synchronization channel corresponding to the pilot obtained. The synchronization channel message includes the pilot pseudo-noise offset. The chip duration in IS-95 and the single carrier version of IS-2000 is 0.814 microseconds. The duration of the entire pilot code is 26.67 ms ($2^{15} \div 1.2288 \times 10^6$). Thus, 26.67 ms can be the maximum length of time an attempted search for a CDMA pilot **126** may take under these standards.

[**0022**] After finding a usable CDMA system, the wireless terminal **130** can search for a more preferable CDMA system. In particular, the searcher may be used to find better pilots. A list of pilots to search for may be provided to the searcher. Alternatively, a pilot searcher can try several segments of the pseudo-noise code to find matches with pilots and store those results. One of the rake receiver fingers can be programmed to receive these pilots one after the other and decode the synchronization channels to obtain system information corresponding to the pilot. This may be done while service is still available on the initially acquired CDMA system.

[**0023**] In order to acquire the CDMA system **120** when operating under the AMPS system **110**, the wireless terminal

130 may need to periodically search for CDMA pilots **126** in the appropriate band, by activating the pilot searcher. During the search, the wireless terminal **130** generally will be unable to receive the AMPS control channel **116**. If a wireless communication is initiated by the wireless terminal **130** while the search is in progress, the search may be terminated, and the communication may be completed on the AMPS system **110**. However, since the wireless terminal **130** generally will not be receiving the AMPS control channel **116** during the search for the CDMA pilot **126**, there is a possibility that paging messages that are sent on the AMPS control channel **116** by the AMPS base station **114** will be missed. Missing pages may lead to missed incoming AMPS wireless communications and/or failure of other AMPS features. If the CDMA pilot **126** is weak, and the wireless terminal **130** is configured to periodically search for the CDMA pilot **126** while operating under the AMPS system **110**, this may cause an unacceptably large number of missed pages. Wireless terminals **130** and operating methods according to embodiments of the present invention can reduce or eliminate the possibility of missed pages on the AMPS control channel **116**, and thereby allow improved performance while transitioning from the AMPS system **110** to the CDMA system **120**.

[**0024**] **FIG. 2** is a block diagram of multiple-mode AMPS/CDMA wireless terminals **130** according to embodiments of the present invention. The wireless terminal **130** can include one or more radio frequency transceivers **210** coupled to one or more antennas **212**. An AMPS subsystem **220** and a CDMA subsystem **230** including, for example, respective TDMA and CDMA baseband processors, can operate as interfaces between the transceiver **210** and a controller **240**, to send, receive and/or process AMPS and CDMA control and communications messages, as appropriate. A user interface **260** also may be provided. The user interface can include displays, keyboards, microphones, speakers and/or other conventional elements. The design and operation of the elements of a multiple-mode AMPS/CDMA wireless terminal **130** as described in this paragraph are well known to those having skill in the art and need not be described in further detail. Moreover, it will be understood by those having skill in the art that elements of the transceiver **210**, the AMPS subsystem **220**, the CDMA subsystem **230**, the controller **240** and the user interface **260** may be integrated with one another.

[**0025**] Still referring to **FIG. 2**, multiple-mode AMPS/CDMA wireless terminals and operating methods according to embodiments of the invention also include an AMPS-to-CDMA transition Block **250**. AMPS-to-CDMA transition Block **250** according to embodiments of the present invention can reduce or eliminate the likelihood of missed pages on the AMPS control channel **116**, while attempting to acquire the CDMA pilot **126**. Various embodiments of AMPS-to-CDMA transition **250**, according to embodiments of the invention, now will be described in connection with the flowcharts of FIGS. **3-9**.

[**0026**] Referring now to **FIG. 3**, embodiments of AMPS-to-CDMA transition blocks, such as Block **250** of **FIG. 2**, for multiple-mode AMPS/CDMA wireless terminals, attempt to acquire the CDMA system **120** at the dual mode AMPS/CDMA wireless terminal **130**, independent of receiving a Global Action (GA) overhead message from the AMPS system **110** at the wireless terminal **130**, at Block **310**, while continuing to receive paging messages for the dual mode AMPS/CDMA wireless terminal from the AMPS system **110** over the AMPS control channel **116**, at Block **320**. Referring now to **FIG. 4**, according to other embodiments, if the attempt to acquire the CDMA system at Block **310** is successful at Block **410**, then the dual mode AMPS/CDMA wireless terminal **130** is transitioned from the AMPS system **110** to the CDMA system **120**, at Block **420**.

[**0027**] Referring now to **FIG. 5**, other embodiments of AMPS-to-CDMA transition **250** receive AMPS paging messages for the dual mode AMPS/CDMA wireless terminal **130** from the AMPS control channel **116** at the dual mode AMPS/CDMA wireless terminal **130** during spaced apart time intervals, at Block **510**. At Block **520**, attempts are made to acquire the CDMA system **120** at the dual mode AMPS/CDMA wireless terminal **130** between the spaced apart time intervals. As shown in **FIG. 6**, in other embodiments, if the attempt is successful (Block **410**), then the transition is made to CDMA system (Block **420**).

[**0028**] Referring now to **FIG. 7**, according to other embodiments, paging messages are received from the AMPS system **110** at the wireless terminal **130** during spaced apart time intervals (Block **510** of **FIGS. 5 and 6**) as follows: At Block **710**, a paging message is received from a first frame of an AMPS control channel **116** of the AMPS system **110** at the dual mode AMPS/CDMA wireless terminal **130**. Then, at Block **720**, an AMPS sleep mode is entered. Attempting to acquire the CDMA system **120** between the spaced apart time intervals (Block **520** of **FIGS. 5 and 6**) may be embodied by accumulating CDMA pilot acquisition data during the AMPS sleep mode, at Block **730**. Then, at Block **740**, if the pilot has been acquired, the wireless terminal **130** transitions to CDMA at Block **420**. If the pilot is not acquired at Block **740**, then the receiving an AMPS paging message (Block **710**), entering AMPS sleep mode (Block **720**), and accumulating CDMA pilot acquisition data (Block **730**) is repeated for second and subsequent frames of the AMPS control channel **116**, until the pilot is acquired at Block **740**.

[**0029**] Additional embodiments of FIGS. **5-7** now will be described. These embodiments can use the structure of the datastream of the AMPS control channel **116**, also referred to herein as the AMPS forward control channel, to reduce or eliminate the possibility of missing paging messages on the AMPS control channel **116** at the wireless terminal **130**. An example of a forward control channel datastream according to EIA/TIA-533A is illustrated in **FIG. 8**. The 10-bit dotting sequence **810** and the 11-bit word synchronization sequence **820** are used by the wireless terminal **130** to achieve synchronization with the incoming stream. The datastream includes three streams that are time multiplexed: stream A, stream B and a busy-idle stream. Information is transmitted in fixed length (for example 40-bit) words. Wireless terminals **130** with the least significant bit of their mobile identification number equal to 0 may only receive information in the "A" words **830**, and those with the least significant bit equal to 1 may only receive information in the "B" words **840**. The busy-idle stream includes busy-idle bits **850**. If a busy-idle bit is equal to 0, the reverse control channel from the wireless terminals **130** to the AMPS base stations **114** is busy, and if it is 1, the reverse control channel is idle. Each word is 40 bits long, including 28 bits of content and a parity check, and is repeated five times, as shown in **FIG. 8**. The

five repetitions of the 40-bit words are referred to as a "word block". Each wireless terminal **130** demodulates either the A or B word, but not both, for example using the AMPS subsystem **220** of **FIG. 2**. Furthermore, if the word is received correctly during a first repeat, there is no need to receive it again. When in the idle mode, the mobile station sleeps during the remaining duration of the word block. The datastream is transmitted at 10 kilobits/sec and the duration of the entire datastream shown in **FIG. 8** is 46.3 ms.

[**0030**] Referring back to **FIG. 7**, according to embodiments of the invention, if a CDMA system **120** is to be acquired, the remainder of the sleep mode (Block **720**) after correctly receiving the appropriate word (Block **710**) on the analog forward control channel of **FIG. 8** is used to acquire CDMA pilots (Block **730**). Thus, the wireless terminal **130** switches context between the analog demodulation and the CDMA pilot searcher, for example, by activating the CDMA subsystem **230** and deactivating the AMPS subsystem **220**.

[**0031**] As noted above, the duration of a CDMA pilot sequence may be 26.67 ms. The wireless terminal **130** makes one or more sojourns from the AMPS control channel **116** in order to acquire the CDMA pilot **126**, while still returning to the AMPS control channel **116** to receive its word. In particular, the wireless terminal **130** receives the appropriate word on the AMPS control channel **116**, at Block **710**, enters AMPS sleep mode at Block **720**, and starts CDMA pilot acquisition at Block **730**. Until the point in time when the wireless terminal **130** needs to return to the AMPS control channel **116**, it can receive the CDMA pilot acquisition data **730** at the designated frequency and buffer it. The wireless terminal then returns to the AMPS control channel **116** at Block **710**, assuming the pilot is not acquired. When returning to the AMPS control channel **116** at Block **710**, the accumulated CDMA pilot acquisition data at Block **730** can be used to determine if there is a CDMA pilot at that frequency. If there is one, it can be acquired in the next sojourn.

[**0032**] One technique for determining if there is a CDMA pilot is described in a publication by coinventor Sourour entitled *Direct Sequence Spread Spectrum Acquisition With Fast Search and Parallel Verification in a Multipath Fading Channel,* Proceedings of the First International Symposium on Wireless Personal Multimedia Communications, November 1998, the disclosure of which is hereby incorporated herein by reference. It will be understood that other techniques may be used with embodiments of the present invention to determine if there is a CDMA pilot.

[**0033**] Once the CDMA pilot is acquired at Block **740**, the wireless terminal **130** need not continue to listen to the AMPS control channel **116**. Rather, at Block **420**, it can receive the synchronization channel messages and can continue with remaining initialization procedures, for example, that are described in TIA/EIA/IS-95B. If the CDMA system **120** is discovered to be unacceptable, for example due to unacceptable roaming parameters, overload or other reasons, the wireless terminal can then return to reacquire the AMPS control channel **116**. Alternatively, the AMPS control channel **116** can be continued to be listened to until an acceptable CDMA system **120** is acquired and/or fully initialized.

[**0034**] In some embodiments that were described above, an attempt to acquire a CDMA system (Block **410**) or an attempt to acquire the pilot (Block **740**) may be successful, only to find later that the CDMA system is not acceptable. For example, the following scenario is possible: the wireless terminal **130** can acquire the pilot (Block **410** or **740**), transition to CDMA (Block **420**), receive the complete CDMA synchronization message, for example nine frames of 26.666 ms each, and then using the System ID (SID) in the synchronization channel message, can determine that the system is not acceptable. The system may not be acceptable because the wireless terminal **130** can maintain information about which systems and networks it is permitted to use. This encoding of carrier preferences is called a "preferred roaming list", as described in TIA/EIA/IS-683-A, and is analogous to the intelligent roaming database of IS-136 systems. An unacceptable system may be one that is not in the wireless terminal's preferred roaming list.

[**0035**] Embodiments of the invention can reduce or prevent the likelihood of acquiring the CDMA pilot, only to later find that the CDMA system is not acceptable. An example of these embodiments is shown in **FIG. 9**. Embodiments of **FIG. 9** may be used as part of the test of whether an attempt to acquire the CDMA system is successful (Block **410** of FIGS. **4** or **6**) or as further processing in the decision of whether the pilot has been acquired (Block **740** of **FIG. 7**).

[**0036**] In general, in **FIG. 9**, sufficient CDMA pilot acquisition data is accumulated to acquire the CDMA pilot and the CDMA SID field. In particular, referring to **FIG. 9**, the CDMA pilot **126** is acquired at Block **910**. At Block **920**, the CDMA SID also is acquired, and at Block **930**, the CDMA SID is error corrected. If the CDMA SID is acquired and error corrected successfully, and it is determined that the CDMA SID is acceptable, the transition to CDMA (Block **420**) performed. Thus, the possibility of the wireless terminal **130** acquiring the pilot, leaving the AMPS mode and later determining that the CDMA system is not acceptable can be reduced or eliminated.

[**0037**] Additional details of determining whether an attempt to acquire the CDMA system are successful according to embodiments of **FIG. 9**, by pilot buffering with synchronization channel look-ahead for the SID, now will be described. In standards IS-95 and IS-2000, the synchronization channel message body is 170 bits. Its contents are shown in the following Table:

TABLE

Field	Length (bits)
MSG_TYPE	8
P_REV	8
MIN_P_REV	8
SID	15
NID	16
PILOT_PN	9
LC_STATE	42
SYS_TIME	36
LP_SEC	8
LTM_OFF	6
DAYLT	1
PRAT	2
CDMA_FREQ	11

[**0038**] The message body shown in the above Table is preceded by an 8-bit message length field and is followed by

a 30-bit Cyclic Redundancy Check (CRC) to form the synchronization channel message. The synchronization channel frame in IS-95 and IS-2000 includes 32 bits: one start-of-message bit followed by 31 bits of the synchronization channel message. The synchronization channel frame is transmitted over 26.67 ms. Three consecutive synchronization channel frames form a synchronization channel superframe that is 80 ms long. The synchronization channel is transmitted at 1200 bps.

[0039] **FIG. 10** is a detailed timing diagram for the synchronization channel message shown in the above Table. As shown in **FIG. 10**, the 170+8+30 bits of the synchronization channel message is split into three units of 93 bits each with 0 padding (80 bits). Each of the 93 bit units is formatted for transmission in a synchronization channel superframe as follows: Each of the 93 bit units is broken into three units of 31 bits each. A start-of-message bit is added to the front of each of the 31 bits and each of the resulting 32 bits that fits into a synchronization channel frame. Consequently, synchronization channel superframes (9 synchronization channel frames) are used to transmit the synchronization channel message.

[0040] However, in order for the wireless terminal **130** to decide that the CDMA system **120** is not desirable, it may not need to receive the entire synchronization channel message of **FIG. 10**. It may only need to receive enough synchronization channel frames until it reaches the SID field of the message. From the above Table, and from **FIG. 10**, it can be seen that the SID is transmitted during the second frame of the synchronization channel message. Thus, the wireless terminal **130** need only receive two frames of the 9 frame synchronization channel message to decide whether it needs to continue to listen to the remaining part of the synchronization channel message or to leave the CDMA pilot channel **126** and go back to the AMPS control channel **116**. By performing synchronization channel look-ahead, considerable time and/or battery power can be saved.

[0041] Accordingly, referring again to **FIG. 9**, the CDMA pilot is acquired at Block **910**. During the course of pilot acquisition at Block **910**, the AMPS control channel **116** is continued to be listened to and the wireless terminal **130** still continues to operate under the AMPS system **110**. The pilot continues to be acquired until the first two frames of the synchronization channel are acquired, so that the CDMA SID is acquired at Block **920**. The received SID then is used to determine if service can be provided on the CDMA system **120**. If no, then a transition to CDMA (Block **420**) is not performed, and the AMPS paging message is continued to be received at Block **710**. If yes, then the transition to CDMA (Block **420**) is performed, and CDMA initialization is performed.

[0042] When the CDMA SID is acquired at Block **920** using a synchronization channel look-ahead described above, it will be understood that the SID may include an error therein. In particular, CDMA synchronization channel frames that were described in **FIG. 10** do not include CRC bits. Only the full synchronization channel message has CRC bits at the end. Since it is desirable that the wireless terminal **130** make a decision on the SID after receiving only two frames as described above, the wireless terminal **130** may use a different technique to decide the validity of the synchronization channel frames before receiving the whole message. For example, the CDMA SID may be error corrected (Block **930**) using a technique that is described in U.S. patent application Ser. No. 09/300,184 to Guey entitled Rate Detection Apparatus and Method for Variable Rate Speech Encoding, filed Apr. 27, 1999, the disclosure of which is hereby incorporated herein by reference in its entirety. This technique may be used in IS-95 to detect the validity of traffic channel frames at data rates of 1.2 and 2.4 kbps. According to embodiments of the present invention, this technique may be used for CDMA SID error correction at Block **930**, without the need to wait to receive the CRC for the entire synchronization channel message. Other techniques also may be used.

[0043] If attempts are made to acquire the CDMA system **120** according to the above-described embodiments during every AMPS control channel word, the battery power in the wireless terminal **130** may be drained excessively. Moreover, because the wireless terminal **130** generally changes location slowly relative to the locations of the AMPS base stations **114** and the CDMA base stations **124**, it may be unnecessary to attempt to acquire the CDMA system **120** during every analog control channel word block. According to embodiments of the present invention as shown in **FIG. 11**, the spaced apart time intervals during which an attempt is made to acquire the CDMA system **120** may be increasingly spaced apart. In particular, as shown in **FIG. 11**, after a determination is made as to whether an attempt to acquire CDMA is successful at Block **410**, embodiments of the invention can wait for a predetermined time (Block **1110**) until a new attempts is made to acquire the CDMA system at Block **310**. In some embodiments, the wait may be a constant time or a constant number of AMPS control channel words. In yet other embodiments of the invention, the wait time may increase with each cycle of operations. In still other embodiments, the wait time may increase until a predetermined maximum wait time is achieved, after which the maximum wait time is maintained. Accordingly, adaptive embodiments may be provided.

[0044] FIGS. **12A-12B**, which when placed together as indicated form **FIG. 12**, are a flowchart illustrating embodiments of the present invention that include acquiring the CDMA SID (**FIG. 9**) and adjusting the wait time (**FIG. 11**). In order to control the time between successive acquisition attempts (Inter-Acq-time), two parameters are used: Min-inter-Acq-time and Max-inter-Acq-time. These parameters are used as bounding values for the duration between successive searches (Inter-Acq-time). For example, Min_inter-Acq-time may be set to one minute and Max_inter_Acq_time may be set to two hours. The Inter-Acq-time may be increased exponentially (for example, doubled) up to Max-inter-Acq-time. Thus, in an area where CDMA is unavailable, battery current need not be continuously wasted.

[0045] Referring to **FIG. 12**, the value of Inter-Acq-time is adjusted as follows: When a new geographical region is entered or when the wireless terminal **130** is powered on, Inter-Acq-time:=Min-inter-Acq-time (Block **1202**). After CDMA acquisition is attempted unsuccessfully, Inter-Acq-time:=min(Max-inter-Acq-time, 2×Inter-Acq-time) (Block **1220**).

[0046] At the beginning of operations, a CDMA-Acq-timer is started (Block **1204**) to trigger after time Inter-Acq-time. The wireless terminal **130** tries to receive the appro-

priate word (A or B) on the AMPS forward control channel (Block **1206**) and repeats this until the word is successfully received (Block **1208**). If the timer has reached 0 (Block **1210**), CDMA acquisition is started (Block **1212**) after setting another timer (Interrupt-timer) to interrupt at the start of the next frame. The Interrupt-timer is used to return to the analog control channel at the start of a new frame. If the CDMA-Acq-time has not reached 0, the operations wait (Block **1214**) until either the frame boundary is reached or until the CDMA-Acq-timer reaches 0.

[**0047**] In the former case, the reception of the next frame is started (Block **1216**) and in the latter, CDMA acquisition is started (Block **1212**) by starting/restarting the CDMA pilot searcher (Block **1218**) until pilot acquisition is done (Block **1216**), and reading the SID (Block **1222**). If the SID is acceptable (Block **1224**), service is provided (Block **1226**) and operations are terminated. Otherwise, Inter-Acq-time is adjusted as was described above in connection with Block **1220**, and the operations are restarted at Block **1204**. During any part of this procedure, if the Interrupt-timer is triggered (Block **1230**), the operations are interrupted (Block **1232**) to start receiving the next frame on the analog control channel (Block **1206**).

[**0048**] Thus, embodiments of **FIG. 12** can provide that the wireless terminal **130** does not miss pages on the AMPS control channel **116** when a search for a CDMA pilot **126** is conducted. The CDMA search also may be adapted to the wireless environment so that if CDMA is not available in a given region, the time between successive searches can be increased exponentially up to a maximum limit. Battery current therefore need not be drained excessively.

[**0049**] The present invention has been described with reference to block diagram and flowchart illustrations of methods and wireless terminals according to embodiments of the invention. It will be understood that blocks of the block diagrams and/or flowchart illustrations, and combinations of blocks, can be implemented by computer program instructions. These computer program instructions may be provided to a processor of a general purpose computer, special purpose computer, or other programmable data processing apparatus to produce a wireless terminal, such that the instructions, which execute via the processor of the computer or other programmable data processing apparatus, create circuits, systems, subsystems or other structures for implementing the functions specified in the block diagram and/or flowchart block or blocks.

[**0050**] These computer program instructions may also be stored in a computer-readable memory that can direct a wireless terminal to function in a particular manner, such that the instructions stored in the computer-readable memory produce a wireless terminal including instructions which implement the function specified in the block diagram and/or flowchart block or blocks.

[**0051**] The computer program instructions may also be loaded in a wireless terminal to cause a series of operational steps to be performed, to produce a process or method such that the instructions which execute in the wireless terminal provide steps for implementing the functions specified in the block diagram and/or flowchart block or blocks. Moreover, unless indicated to the contrary, operational steps need not be performed in the order that is illustrated.

[**0052**] In the drawings and specification, there have been disclosed typical preferred embodiments of the invention and, although specific terms are employed, they are used in a generic and descriptive sense only and not for purposes of limitation, the scope of the invention being set forth in the following claims.

1. A method of operating a multiple-mode Advanced Mobile Phone Service (AMPS) system/Code Division Multiple Access (CDMA) system wireless terminal comprising:

attempting to acquire the CDMA system at the multiple-mode AMPS/CDMA wireless terminal independent of receiving a Global Action (GA) overhead message from the AMPS system at the multiple-mode AMPS/CDMA wireless terminal, while continuing to receive paging messages for the multiple-mode AMPS/CDMA wireless terminal from the AMPS system.

2. The method according to claim 1 wherein the attempting to acquire the CDMA system at the multiple-mode AMPS/CDMA wireless terminal independent of receiving a Global Action (GA) overhead message from the AMPS system at the multiple-mode AMPS/CDMA wireless terminal, while continuing to receive paging messages for the multiple-mode AMPS/CDMA wireless terminal from the AMPS system is followed by:

transitioning the multiple-mode AMPS/CDMA wireless terminal from the AMPS system to the CDMA system in response to the attempting to acquire the CDMA system at the multiple-mode AMPS/CDMA wireless terminal independent of receiving a Global Action (GA) overhead message from the AMPS system at the multiple-mode AMPS/CDMA wireless terminal, while continuing to receive paging messages for the multiple-mode AMPS/CDMA wireless terminal from the AMPS system being successful.

3. The method according to claim 1 wherein the attempting to acquire the CDMA system at the multiple-mode AMPS/CDMA wireless terminal independent of receiving a Global Action (GA) overhead message from the AMPS system at the multiple-mode AMPS/CDMA wireless terminal, while continuing to receive paging messages for the multiple-mode AMPS/CDMA wireless terminal from the AMPS system comprises:

receiving paging messages for the multiple-mode AMPS/CDMA wireless terminal from the AMPS system at the multiple-mode AMPS/CDMA wireless terminal during spaced apart time intervals; and

attempting to acquire the CDMA system at the multiple-mode AMPS/CDMA wireless terminal between the spaced apart time intervals.

4. The method according to claim 3:

wherein the receiving paging messages for the multiple-mode AMPS/CDMA wireless terminal from the AMPS system at the multiple-mode AMPS/CDMA wireless terminal during spaced apart time intervals comprises:

receiving a paging message from a first frame of an AMPS control channel of the AMPS system at the multiple-mode AMPS/CDMA wireless terminal;

entering an AMPS sleep mode after the receiving a paging message from the first frame of an AMPS control channel of the AMPS system at the multiple-mode AMPS/CDMA wireless terminal; and

wherein the attempting to acquire the CDMA system at the multiple-mode AMPS/CDMA wireless terminal between the spaced apart time intervals comprises accumulating CDMA pilot acquisition data during the AMPS sleep mode;

the method further comprising repeating the receiving a paging message from a first frame of an AMPS control channel of the AMPS system at the multiple-mode AMPS/CDMA wireless terminal, the entering an AMPS sleep mode after the receiving a paging message from a first frame of an AMPS control channel of the AMPS system at the multiple-mode AMPS/CDMA wireless terminal and the accumulating CDMA pilot acquisition data during the AMPS sleep mode, for second and subsequent frames of the AMPS control channel of the AMPS system.

5. The method according to claim 4 wherein the repeating the receiving a paging message from a first frame of an AMPS control channel of the AMPS system at the multiple-mode AMPS/CDMA wireless terminal, the entering an AMPS sleep mode after the receiving a paging message from a first frame of an AMPS control channel of the AMPS system at the multiple-mode AMPS/CDMA wireless terminal and the accumulating CDMA pilot acquisition data during the AMPS sleep mode, for second and subsequent frames of the AMPS control channel of the AMPS system, is performed until sufficient CDMA pilot acquisition data is accumulated to acquire the CDMA pilot.

6. The method according to claim 5 wherein the following is performed after the repeating the receiving a paging message from a first frame of an AMPS control channel of the AMPS system at the multiple-mode AMPS/CDMA wireless terminal, the entering an AMPS sleep mode after the receiving a paging message from a first frame of an AMPS control channel of the AMPS system at the multiple-mode AMPS/CDMA wireless terminal and the accumulating CDMA pilot acquisition data during the AMPS sleep mode, for second and subsequent frames of the AMPS control channel of the AMPS system is performed until sufficient CDMA pilot acquisition data is accumulated to acquire the CDMA pilot:

terminating the receiving paging messages for the multiple-mode AMPS/CDMA wireless terminal from the AMPS system at the multiple-mode AMPS/CDMA wireless terminal during the spaced apart time intervals, in response to the sufficient CDMA pilot acquisition data being accumulated to acquire the CDMA pilot.

7. The method according to claim 4 wherein the repeating the receiving a paging message from a first frame of an AMPS control channel of the AMPS system at the multiple-mode AMPS/CDMA wireless terminal, the entering an AMPS sleep mode after the receiving a paging message from a first frame of an AMPS control channel of the AMPS system at the multiple-mode AMPS/CDMA wireless terminal and the accumulating CDMA pilot acquisition data during the AMPS sleep mode, for second and subsequent frames of the AMPS control channel of the AMPS system, is performed until sufficient CDMA pilot acquisition data is accumulated to acquire the CDMA pilot and a CDMA System ID (SID) field.

8. The method according to claim 7 wherein the following is performed after the repeating the receiving a paging message from a first frame of an AMPS control channel of the AMPS system at the multiple-mode AMPS/CDMA wireless terminal, the entering an AMPS sleep mode after the receiving a paging message from a first frame of an AMPS control channel of the AMPS system at the multiple-mode AMPS/CDMA wireless terminal and the accumulating CDMA pilot acquisition data during the AMPS sleep mode, for second and subsequent frames of the AMPS control channel of the AMPS system is performed until sufficient CDMA pilot acquisition data is accumulated to acquire the CDMA pilot and a CDMA System ID (SID) field:

terminating the receiving paging messages for the multiple-mode AMPS/CDMA wireless terminal from the AMPS system at the multiple-mode AMPS/CDMA wireless terminal during spaced apart time intervals in response to sufficient CDMA pilot acquisition data being accumulated to acquire the CDMA pilot and a CDMA System ID (SID) field.

9. The method according to claim 4 wherein following is performed after the repeating the receiving a paging message from a first frame of an AMPS control channel of the AMPS system at the multiple-mode AMPS/CDMA wireless terminal, the entering an AMPS sleep mode after the receiving a paging message from a first frame of an AMPS control channel of the AMPS system at the multiple-mode AMPS/CDMA wireless terminal and the accumulating CDMA pilot acquisition data during the AMPS sleep mode, for second and subsequent frames of the AMPS control channel of the AMPS system is performed until sufficient CDMA pilot acquisition data is accumulated to acquire the CDMA pilot and a CDMA System ID (SID) field:

error correcting the CDMA SID field.

10. The method according to claim 1 wherein the attempting to acquire the CDMA system at the multiple-mode AMPS/CDMA wireless terminal independent of receiving a Global Action (GA) overhead message from the AMPS system at the multiple-mode AMPS/CDMA wireless terminal, while continuing to receive paging messages for the multiple-mode AMPS/CDMA wireless terminal from the AMPS system is repeatedly performed during spaced apart time intervals.

11. The method according to claim 1 wherein the attempting to acquire the CDMA system at the multiple-mode AMPS/CDMA wireless terminal independent of receiving a Global Action (GA) overhead message from the AMPS system at the multiple-mode AMPS/CDMA wireless terminal, while continuing to receive paging messages for the multiple-mode AMPS/CDMA wireless terminal from the AMPS system is repeatedly performed during increasingly spaced apart time intervals.

12. A method of operating a multiple-mode Advanced Mobile Phone Service (AMPS) system/Code Division Multiple Access (CDMA) system wireless terminal comprising:

receiving paging messages for the multiple-mode AMPS/CDMA wireless terminal from the AMPS system at the multiple-mode AMPS/CDMA wireless terminal during spaced apart time intervals; and

attempting to acquire the CDMA system at the multiple-mode AMPS/CDMA wireless terminal between the spaced apart time intervals.

13. The method according to claim 12:

wherein the receiving paging messages for the multiple-mode AMPS/CDMA wireless terminal from the AMPS system at the multiple-mode AMPS/CDMA wireless terminal during spaced apart time intervals comprises:

receiving a paging message from a first frame of an AMPS control channel of the AMPS system at the multiple-mode AMPS/CDMA wireless terminal; and

entering an AMPS sleep mode after the receiving a paging message from a first frame of an AMPS control channel of the AMPS system at the multiple-mode AMPS/CDMA wireless terminal; and

wherein the attempting to acquire the CDMA system at the multiple-mode AMPS/CDMA wireless terminal between the spaced apart time intervals comprises accumulating CDMA pilot acquisition data during the AMPS sleep mode;

the method further comprising repeating the receiving a paging message from a first frame of an AMPS control channel of the AMPS system at the multiple-mode AMPS/CDMA wireless terminal, the entering an AMPS sleep mode after the receiving a paging message from a first frame of an AMPS control channel of the AMPS system at the multiple-mode AMPS/CDMA wireless terminal and the accumulating CDMA pilot acquisition data during the AMPS sleep mode, for second and subsequent frames of the AMPS control channel of the AMPS system.

14. The method according to claim 13 wherein the repeating the receiving a paging message from a first frame of an AMPS control channel of the AMPS system at the multiple-mode AMPS/CDMA wireless terminal, the entering an AMPS sleep mode after the receiving a paging message from a first frame of an AMPS control channel of the AMPS system at the multiple-mode AMPS/CDMA wireless terminal and the accumulating CDMA pilot acquisition data during the AMPS sleep mode, for second and subsequent frames of the AMPS control channel of the AMPS system is performed until sufficient CDMA pilot acquisition data is accumulated to acquire the CDMA pilot.

15. The method according to claim 14 wherein the following is performed after the repeating the receiving a paging message from a first frame of an AMPS control channel of the AMPS system at the multiple-mode AMPS/CDMA wireless terminal, the entering an AMPS sleep mode after the receiving a paging message from a first frame of an AMPS control channel of the AMPS system at the multiple-mode AMPS/CDMA wireless terminal and the accumulating CDMA pilot acquisition data during the AMPS sleep mode, for second and subsequent frames of the AMPS control channel of the AMPS system is performed until sufficient CDMA pilot acquisition data is accumulated to acquire the CDMA pilot:

terminating the receiving paging messages for the multiple-mode AMPS/CDMA wireless terminal from the AMPS system at the multiple-mode AMPS/CDMA wireless terminal during spaced apart time intervals, in response to the sufficient CDMA pilot acquisition data being accumulated to acquire the CDMA pilot.

16. The method according to claim 13 wherein the repeating the receiving a paging message from a first frame of an AMPS control channel of the AMPS system at the multiple-mode AMPS/CDMA wireless terminal, the entering an AMPS sleep mode after the receiving a paging message from a first frame of an AMPS control channel of the AMPS system at the multiple-mode AMPS/CDMA wireless terminal and the accumulating CDMA pilot acquisition data during the AMPS sleep mode, for second and subsequent frames of the AMPS control channel of the AMPS system is performed until sufficient CDMA pilot acquisition data is accumulated to acquire the CDMA pilot and a CDMA System ID (SID) field.

17. The method according to claim 16 wherein the following is performed after the repeating the receiving a paging message from a first frame of an AMPS control channel of the AMPS system at the multiple-mode AMPS/CDMA wireless terminal, the entering an AMPS sleep mode after the receiving a paging message from a first frame of an AMPS control channel of the AMPS system at the multiple-mode AMPS/CDMA wireless terminal and the accumulating CDMA pilot acquisition data during the AMPS sleep mode, for second and subsequent frames of the AMPS control channel of the AMPS system is performed until sufficient CDMA pilot acquisition data is accumulated to acquire the CDMA pilot and a CDMA System ID (SID) field:

terminating the receiving paging messages for the multiple-mode AMPS/CDMA wireless terminal from the AMPS system at the multiple-mode AMPS/CDMA wireless terminal during spaced apart time intervals, in response to the sufficient CDMA pilot acquisition data being accumulated to acquire the CDMA pilot and a CDMA System ID (SID) field.

18. The method according to claim 16 wherein the following is performed after the repeating the receiving a paging message from a first frame of an AMPS control channel of the AMPS system at the multiple-mode AMPS/CDMA wireless terminal, the entering an AMPS sleep mode after the receiving a paging message from a first frame of an AMPS control channel of the AMPS system at the multiple-mode AMPS/CDMA wireless terminal and the accumulating CDMA pilot acquisition data during the AMPS sleep mode, for second and subsequent frames of the AMPS control channel of the AMPS system is performed until sufficient CDMA pilot acquisition data is accumulated to acquire the CDMA pilot and a CDMA System ID (SID) field:

error correcting the CDMA SID field.

19. The method according to claim 12 wherein the receiving paging messages for the multiple-mode AMPS/CDMA wireless terminal from the AMPS system at the multiple-mode AMPS/CDMA wireless terminal during spaced apart time intervals is repeatedly performed during increasingly spaced apart time intervals.

20. A multiple-mode wireless terminal comprising:

an Advanced Mobile Phone Service (AMPS) subsystem that is configured to communicate with an AMPS wireless communications system;

a Code Division Multiple Access (CDMA) subsystem that is configured to communicate with a CDMA wireless communications system; and

a controller that is configured to control the AMPS subsystem and the CDMA subsystem to attempt to acquire the CDMA system independent of receiving a Global Action (GA) overhead message from the AMPS

system, while continuing to receive paging messages for the multiple-mode AMPS/CDMA wireless terminal from the AMPS system.

21. The multiple-mode wireless terminal according to claim 20 wherein the controller is further configured to control the AMPS subsystem and the CDMA subsystem to transition the multiple-mode AMPS/CDMA wireless terminal from the AMPS system to the CDMA system in response to the attempt to acquire the CDMA system independent of receiving a Global Action (GA) overhead message from the AMPS system, while continuing to receive paging messages for the multiple-mode AMPS/CDMA wireless terminal from the AMPS system being successful.

22. The multiple-mode wireless terminal according to claim 20 wherein the controller is further configured to control the AMPS subsystem and the CDMA subsystem to receive paging messages for the multiple-mode AMPS/CDMA wireless terminal from the AMPS system during spaced apart time intervals, and to attempt to acquire the CDMA system between the spaced apart time intervals.

23. The multiple-mode wireless terminal according to claim 20 wherein the controller is further configured to control the AMPS subsystem and the CDMA subsystem to receive a paging message from a first frame of an AMPS control channel of the AMPS system, to enter an AMPS sleep mode after receiving the paging message from the first frame, to accumulate CDMA pilot acquisition data during the AMPS sleep mode and to repeat the receiving a paging message, the entering an AMPS sleep mode and the accumulating CDMA pilot acquisition data during the AMPS sleep mode, for second and subsequent frames of the AMPS control channel of the AMPS system.

24. The multiple-mode wireless terminal according to claim 23 wherein the controller is further configured to control the AMPS subsystem and the CDMA subsystem to repeat the receiving a paging message, the entering an AMPS sleep mode and the accumulating CDMA pilot acquisition data during the AMPS sleep mode, for second and subsequent frames of the AMPS control channel of the AMPS system until sufficient CDMA pilot acquisition data is accumulated to acquire the CDMA pilot.

25. The multiple-mode wireless terminal according to claim 23 wherein the controller is further configured to control the AMPS subsystem and the CDMA subsystem to terminate the receiving paging messages from the AMPS system during the spaced apart time intervals in response to the sufficient CDMA pilot acquisition data being accumulated to acquire the CDMA pilot.

26. The multiple-mode wireless terminal according to claim 23 wherein the controller is further configured to control the AMPS subsystem and the CDMA subsystem to repeat the receiving a paging message, the entering an AMPS sleep mode and the accumulating CDMA pilot acquisition data during the AMPS sleep mode, for second and subsequent frames of the AMPS control channel of the AMPS system until sufficient CDMA pilot acquisition data is accumulated to acquire the CDMA pilot and a CDMA System ID (SID) field.

27. The multiple-mode wireless terminal according to claim 26 wherein the controller is further configured to control the AMPS subsystem and the CDMA subsystem to terminate the receiving paging messages from the AMPS system during the spaced apart time intervals in response to the sufficient CDMA pilot acquisition data being accumulated to acquire the CDMA pilot and the CDMA SID field.

28. The multiple-mode wireless terminal according to claim 26 wherein the controller is further configured to error correct the CDMA SID field.

29. The multiple-mode wireless terminal according to claim 20 wherein the controller is further configured to control the AMPS subsystem and the CDMA subsystem to attempt to acquire the CDMA system during spaced apart time intervals.

30. The multiple-mode wireless terminal according to claim 20 wherein the controller is further configured to control the AMPS subsystem and the CDMA subsystem to attempt to acquire the CDMA system during increasingly spaced apart time intervals.

31. A multiple-mode wireless terminal comprising:

an Advanced Mobile Phone Service (AMPS) subsystem that is configured to communicate with an AMPS wireless communications system;

a Code Division Multiple Access (CDMA) subsystem that is configured to communicate with a CDMA wireless communications system; and

a controller that is configured to control the AMPS subsystem and the CDMA subsystem to receive paging messages for the multiple-mode AMPS/CDMA wireless terminal from the AMPS system during spaced apart time intervals, and to attempt to acquire the CDMA system between the spaced apart time intervals.

32. The multiple-mode wireless terminal according to claim 31 wherein the controller is further configured to control the AMPS subsystem and the CDMA subsystem to receive a paging message from a first frame of an AMPS control channel of the AMPS system, to enter an AMPS sleep mode after receiving the paging message from the first frame, to accumulate CDMA pilot acquisition data during the AMPS sleep mode and to repeat the receiving a paging message, the entering an AMPS sleep mode and the accumulating CDMA pilot acquisition data during the AMPS sleep mode, for second and subsequent frames of the AMPS control channel of the AMPS system.

33. The multiple-mode wireless terminal according to claim 31 wherein the controller is further configured to control the AMPS subsystem and the CDMA subsystem to receive a paging message from a first frame of an AMPS control channel of the AMPS system, to enter an AMPS sleep mode after receiving the paging message from the first frame, to accumulate CDMA pilot acquisition data during the AMPS sleep mode and to repeat the receiving a paging message, the entering an AMPS sleep mode and the accumulating CDMA pilot acquisition data during the AMPS sleep mode, for second and subsequent frames of the AMPS control channel of the AMPS system until sufficient CDMA pilot acquisition data is accumulated to acquire the CDMA pilot.

34. The multiple-mode wireless terminal according to claim 31 wherein the controller is further configured to control the AMPS subsystem and the CDMA subsystem to receive a paging message from a first frame of an AMPS control channel of the AMPS system, to enter an AMPS sleep mode after receiving the paging message from the first frame, to accumulate CDMA pilot acquisition data during the AMPS sleep mode and to repeat the receiving a paging message, the entering an AMPS sleep mode and the accu-

mulating CDMA pilot acquisition data during the AMPS sleep mode, for second and subsequent frames of the AMPS control channel of the AMPS system until sufficient CDMA pilot acquisition data is accumulated to acquire the CDMA pilot and a CDMA System ID (SID) field.

35. The multiple-mode wireless terminal according to claim 33 wherein the controller is further configured to control the AMPS subsystem and the CDMA subsystem to terminate the receiving paging messages from the AMPS system in response to the sufficient CDMA pilot acquisition data being accumulated to acquire the CDMA pilot.

36. The multiple-mode wireless terminal according to claim 34 wherein the controller is further configured to control the AMPS subsystem and the CDMA subsystem to terminate the receiving paging messages from the AMPS system in response to the sufficient CDMA pilot acquisition data being accumulated to acquire the CDMA pilot and the CDMA SID field.

37. The multiple-mode wireless terminal according to claim 34 wherein the controller is further configured to error correct the CDMA SID field.

38. The multiple-mode wireless terminal according to claim 31 wherein the controller is further configured to control the AMPS subsystem and the CDMA subsystem to attempt to acquire the CDMA system at increasingly spaced apart time intervals.

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